

LIGHTNING AND AQUATICS SAFETY: A CAUTIONARY PERSPECTIVE FOR INDOOR POOLS

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1.0 Abstract. Lightning behavior is arbitrary, capricious, and random. A first flash to earth can travel tens of miles from a distant cloud to a grounded object. Statistically, more lightning originates from the back edge of a thundercloud than from the front side, making recreation activity resumption decisions difficult. Risk management of the lightning hazard necessarily calls for a cautious and conservative approach. This paper describes lightning pathways to interior structures and provides references to recent national codes and standards. It recommends guidelines for decision-making in order to maximize lightning safety for indoor pools.

2.0 Physics of Lightning. There are some 22 million cloud-to-ground lightning flashes in the USA annually. A helpful lightning flash density map can be seen at http://www.lightningsafety.com/nlsi_info/lightningmaps/US_FDlightning.html Lightning travels at about 1000 feet in a millionth of a second. A typical flash is as thick as one's thumb. Lightning's currents average about 25,000 amps with voltages in the hundreds of millions. Lightning follows Benjamin Franklin's maxim of "Path of Least Resistance" through the air and along or through the ground. According to insurance information, the ratio of damage due to indirect effects vs. direct effects is a ratio of 2000:1. This means that if lightning strikes the ground near an indoor pool, depending upon localized circumstances, it may be conducted into the building via low resistance conductors. These can be:

- Buried or Pole-Mounted Telephone and Electric Wires
- Buried Metal Water Lines or Gas Lines
- Metal Light Masts in Parking Lots with AC Power Fed from the Building
- Contiguous Fences to the Building
- Cable TV Lines, both Aerial and Buried
- Root Systems of Nearby Trees
- Wet Ground and Wet Paved Parking Lots (from rain) Adjacent to Buildings

3.0 Statistics. Observable lightning effects inside pool buildings have included: main circulation pump destroyed; injuries to employees touching electrical panels; concrete footing of slide blown apart; and visible lightning inside the pool area. The authors know of no databases recording deaths to persons in indoor pools. Lightning studies from NOAA over 35 years only show generalized activities or locations of lightning victims:

- Under Trees = 13.7%
- Water related (fishing/boating/swimming) = 8.1%
- Golfing = 3.9%
- Driving machinery = 3.0%
- Telephone-related = 2.4%
- Open fields/ballparks = 26.8%

Radios/antennas = 0.7%

All others/unknown categories = 40.4%

However, lightning incidents to persons in non-pool buildings, such as houses, apartments, office buildings, and small shelters are well characterized by thousands of examples. Such incidents describe lightning injuries to people indoors on telephones, in contact with domestic water (sinks, tubs, showers) and touching metal doors, windows, and other outside-to-inside conductors.

4.0 Codes and Standards. An Internet search in “Google” under “indoor pools and lightning” displays more than 2,700 citations. Many of them describe swimming pool safety procedures when under a threat of lightning. Six states have recommendations or regulations for suspending indoor pool activities when under the threat of lightning: Delaware; North Dakota; South Dakota; Maryland; Rhode Island; and Michigan. Delaware’s state code states “during electrical storms the use of a pool (indoor or outdoor) shall be prohibited.” Several large national groups describe building interior pool hazards (*) or have recommended indoor pool activity suspension (**) when nearby thunderstorms threaten.

-National Athletic Trainers Assn.** (NATA)

www.nata.org/publications/otherpub/lightning.pdf

-National Collegiate Athletic Assn.* (NCAA)

www.ncaa.org/library/sports_sciences/sports_med_handbook/2002-03/1d.pdf

-American College of Emergency Physicians ** (ACEP)

www.acep/1,5223,0.html

-US Swimming, Inc. ** www.usa-swimming.org/coaches/sq_lightning.htm

-YMCA Services Corporation**

www.yservicescorp.com/Docs/Guidelines/LightningPoolGuide.doc

All pool buildings should be equipped with lightning protection as specified in the most recent version of National Fire Protection Association’s NFPA-780 Standard for the Installation of Lightning Protection Systems. Special attention should be paid to surge protection and bonding issues. A comprehensive inspection by a qualified electrician should be conducted every five years.

5.0 Recommendations for Lightning Safety at Indoor Pools.

5.1 Recognize the threat. We suggest detection methods such as: NOAA Weather Radio; televised weather reports; seeing lightning and/or hearing associated thunder; or subscription services such as www.lightningstorm.com. We do not recommend expensive dedicated lightning detectors. (See the NLSI web site for more details on lightning detection. Go to: www.lightningsafety.com/nlsi_lhm/overview2002.html

5.2 Identify in advance SAFE/NOT SAFE places. SAFE = dry areas inside large permanent buildings. NOT SAFE = near electrical conductors, electrical equipment, metal objects (lifeguard stands, ladders, diving boards), and water, including showers.

5.3 Action to suspend activities. When lightning is within 6-8 miles, evacuate people to safe areas. Guards should secure the entrance to the pool deck.

5.4 When should activities resume? Wait 30 minutes after the last observed lightning or thunder, since lightning may occur from the back end of the passing thunderstorm.

6.0 Conclusion. There is a built-in conflict between indoor pool activities and lightning safety. Both recreational swimming and competitive swimming events are based upon three icons of entertainment, health, and pleasure. Lightning safety takes priority over enjoyment. A Risk Management/Safety Professional will err on the side of caution every time and will be found harmless from allegations or claims of negligence. Many may object to this conservative approach, however, safety is the prevailing directive.

7.0 References

7.1 Waters, W.E., 1983: Electrical Induction From Distant Current Sources, Prentice Hall, Englewood Cliffs, NJ

7.2 Caixeta, G.P. and Pissolato, Fihlo, J., 1998: Electromagnetic Field Induced In The Interior of a Building by Lightning, Proceedings Intl. Conference on Lightning Protection, Birmingham UK.

7.3 Uman, M.A., et al, 2002: Correlated time derivatives of current, electric field intensity, and magnetic flux density for triggered lightning at 15 m, Jnl. Geophysical Res., Vol 107, No. D13.